

WHAT IS CLAIMED IS:

1. A method of identifying compounds having antimicrobial activity comprising:

- 5 a) combining a polypeptide having substantial similarity to at least a portion of an oomycete FtsZ-mt protein, and a compound to be tested for an ability to bind to said polypeptide, under conditions conducive to binding,
- b) selecting a compound of step (a) that is capable of binding to said polypeptide,
- 10 c) applying a compound of step (b) to a microbe to test for antimicrobial activity, and
- d) selecting a compound of step (c) having antimicrobial activity.

2. The method of claim 1, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 1.

15 3. The method of claim 1, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 3.

4. The method of claim 1, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 5.

20 5. The method of claim 1, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 9.

6. The method of claim 1, wherein said polypeptide is substantially similar or identical to the amino acid sequence of SEQ ID NO: 2.

7. The method of claim 1, wherein said polypeptide is substantially similar or identical to the amino acid sequence of SEQ ID NO: 4.

8. The method of claim 1, wherein said polypeptide is substantially similar or identical to the amino acid sequence of SEQ ID NO: 10.

9. The method of claim 1, wherein the microbe in step (c) is an oomycete.

10. The method of claim 9, wherein the oomycete is *Phytophthora infestans*.

11. A compound identified by the method of claim 1.

12. A method of identifying an inhibitor of FtsZ-mt activity having antimicrobial activity comprising:

5 a) combining a polypeptide having substantial similarity to at least a portion of an oomycete FtsZ-mt protein, and a compound to be tested for an ability to inhibit an activity of said FtsZ-mt protein, under conditions conducive to such inhibition,

b) selecting a compound of step (a) that is capable of inhibiting said FtsZ-mt activity,

10 c) applying a compound of step (b) to a microbe to test for antimicrobial activity, and

d) selecting a compound of step (c) having antimicrobial activity.

15 13. The method of claim 12, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 1.

14. The method of claim 12, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 3.

20 15. The method of claim 12, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 5.

16. The method of claim 12, wherein said polypeptide is encoded by an isolated DNA molecule comprising a nucleotide sequence which is substantially similar or identical to at least a portion of the sequence of SEQ ID NO: 9.

25 17. The method of claim 12, wherein said polypeptide is substantially similar or identical to the amino acid sequence of SEQ ID NO: 2.

18. The method of claim 12, wherein said polypeptide is substantially similar or identical to the amino acid sequence of SEQ ID NO: 4.

30 19. The method of claim 12, wherein said polypeptide is substantially similar or identical to the amino acid sequence of SEQ ID NO: 10.

20. The method of claim 12, wherein the microbe is an oomycete.

21. The method of claim 20, wherein the oomycete is *Phytophthora infestans*.

22. A compound identified by the method of claim 12.

23. A method for suppressing the growth of an oomycete comprising, applying to said oomycete a compound that inhibits the activity of an oomycete FtsZ-mt protein, the protein comprising an amino acid sequence encoded by a nucleotide sequence substantially similar or identical to at least a portion of a polynucleotide sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5 and SEQ ID NO: 9, in an amount sufficient to suppress the growth of said oomycete.

24. A method of crop improvement comprising applying to a plant, plant part, plant seed, or surrounding soil a compound having antimicrobial activity, the compound identified by the method of claim 1, in an amount that inhibits the growth of at least one microbe taxon without significantly suppressing the growth of the plant or plant seed.

25. The method of claim 24, wherein said microbe is selected from the group of genera consisting of: *Lagen*, *Peronophythora*, *Trachysphaera*, *Pythium*, *Phytophthora*, *Albugo*, *Peronospora*, *Plasmopora*, *Pseudoperonospora*, *Bremia*, *Bremiella* and *Basidiophora*.

26. The method of claim 24, wherein said plant is selected from the group consisting of potato, tomato, tobacco, oaks, coffee berry, squash, cotton, sorghum, peas, onion, melon, cucumber, peas, beets, watermelon, peppers, Port Orford Cedar, taro, apple, *Brassica* species, sweet potato, spinach, beans, grapevine, sunflower, hops, lettuce, violets, asters, soybeans, maize, rice, barley, wheat, and rye.

27. A method of crop improvement comprising applying to a plant, plant part, plant seed, or surrounding soil a compound having antimicrobial activity, a compound identified by the method of claim 12, in an amount that inhibits the growth of at least one microbe taxon without significantly suppressing the growth of the plant or seed.

28. The method of claim 27, wherein said microbe is selected from the group of genera consisting of: *Lagen*, *Peronophythora*, *Trachysphaera*, *Pythium*,

*Phytophthora*, *Albugo*, *Peronospora*, *Plasmopora*, *Pseudoperonospora*, *Bremia*, *Bremiella* and *Basidiophora*.

29. The method of claim 27, wherein said plant is selected from the group consisting of potato, tomato, tobacco, oaks, coffee berry, squash, cotton, sorghum, peas,  
5 onion, melon, cucumber, peas, beets, watermelon, peppers, Port Orford Cedar, taro, apple, *Brassica* species, sweet potato (*Ipomea*), spinach, beans, grapevine, sunflower, hops, lettuce, violets, asters, soybeans, maize, rice, barley, wheat, and rye.

30. An isolated nucleic acid which encodes at least a portion of a mitochondrial FtsZ protein obtained from an oomycete.

10 31. The isolated nucleic acid of claim 30, wherein said oomycete is *Phytophthora infestans*.

32. The isolated nucleic acid of claim 30, comprising at least a portion of a sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, and SEQ ID NO: 9.

15 33. An isolated nucleic acid capable of hybridizing to a polynucleotide comprising at least a portion of a sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, and SEQ ID NO: 9, wherein the hybridization takes place in 7% sodium dodecyl sulfate, 0.5 M NaPO<sub>4</sub>, 1 mM EDTA at 50°C for a pre-determined time followed by washing in 2 X SSC, 0.1% sodium dodecyl  
20 sulfate at 50°C.

34. An isolated nucleic acid having a region of at least about 65% sequence identity with at least a portion of a polynucleotide sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 3, SEQ ID NO: 5, and SEQ ID NO: 9.

25 35. An isolated nucleic acid which encodes a polypeptide comprising at least a portion of an amino acid sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, and SEQ ID NO: 10.

36. An isolated peptide comprising at least a portion of an amino acid sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, and SEQ ID NO: 10.

30 37. A method of producing an FtsZ-mt protein which comprises:

a) transforming a suitable host cell with an isolated polynucleotide encoding an oomycete FtsZ-mt protein;

b) culturing said host cells under conditions in which said cells express said isolated polynucleotide; and

5 c) recovering said oomycete FtsZ-mt protein.

38. The method of claim 37, wherein the isolated polynucleotide comprises a sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO:3, SEQ ID NO: 5, and SEQ ID NO: 9.

39. A method of using a virtual screen to identify potential inhibitors of FtsZ-mt proteins which do not inhibit FtsZ-cp proteins comprising the steps of:

a) predicting a three dimensional structure of an FtsZ-mt protein;

b) predicting a three-dimensional structure of an FtsZ-cp protein; and

c) using a computer model to identify molecules which bind to FtsZ-mt proteins but not to FtsZ-cp proteins as potential inhibitors of FtsZ-mt proteins.

40. The method of claim 39, wherein the FtsZ-mt protein is an oomycete FtsZ-mt protein.

41. The method of claim 40, wherein the oomycete is *Phytophthora infestans*.

42. The method of claim 39, wherein the FtsZ-cp protein is a tobacco FtsZ-cp protein.

43. The method of claim 39, wherein the FtsZ-cp protein is an *Arabidopsis* FtsZ-cp protein.

44. The method of claim 39, wherein the FtsZ-mt protein comprises at least 20 amino acids of a sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, and SEQ ID NO: 10.

45. The method of claim 44, wherein the FtsZ-mt protein comprises a sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, and SEQ ID NO: 10.

46. An inhibitor of FtsZ-mt proteins, the inhibitor identified by the method of claim 39.

47. An antimicrobial which inhibits growth of an oomycete, wherein said antimicrobial affects an FtsZ-mt protein of the oomycete.

48. A method of treating a fish infected with an oomycete pathogen comprising application of a compound identified by the method of claim 1.

5 49. The method of claim 48, wherein said oomycete pathogen is a species of *Saprolegnia*.

50. A method of treating a fish infected with an oomycete pathogen comprising application of a compound identified by the method of claim 12.

10 51. The method of claim 50, wherein said oomycete pathogen is a species of *Saprolegnia*.

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